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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/790,567 | 03/01/2004 | Christopher F. Lyons | 03-05 | 9875 |

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| EXAMINER | |
|---|---|
| NOVACEK, CHRISTY L | |
| **ART UNIT** | **PAPER NUMBER** |
| 2822 | |

DATE MAILED: 04/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/790,567 | LYONS ET AL. | |
| | Examiner | Art Unit | |
| | Christy L. Novacek | 2822 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *26 January 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-3, 6-12 and 26-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *26-34* is/are allowed.

6)☒ Claim(s) *1-3 and 6-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

This office action is in response to the amendment filed January 26, 2006.

### *Response to Amendment*

The limitations added to claim 1 are sufficient to overcome the Pike et al. (US 6,420,097) reference. Therefore, the rejections of claims 1-3 and 6-12 as being unpatentable over Pike et al. are hereby withdrawn.

### *Claim Rejections - 35 USC § 103*

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-3, 6 and 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang et al. (US 6,794,230) in view of Kim et al. (US 6,214,637).

Regarding claim 1, Huang discloses forming an organic under-layer (57) over IC material (55), patterning the organic under-layer to form an organic mask structure with a photo-resist mask (58) there-over, and trimming together the organic mask structure and the photo-resist mask structure to lower together a respective critical dimension of each of the organic mask structure and the photo-resist mask structure (Fig. 4a-4d; col. 5, ln. 15 – col. 6, ln. 23). Huang does not disclose that the organic under-layer is rigid, but Huang also does not disclose that the organic under-layer is deformed. Like Huang, Kim discloses a process of using an organic under-layer as an antireflective coating (ARC) for patterning IC material. Kim teaches that it is beneficial to use an ARC of amorphous carbon because the amorphous carbon offers the advantages of superior etch selectivity and the ability to be removed in the same process that is

used to remove the overlying photo-resist (Abstract). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the ARC of Kim for the BARC of Huang because Huang discloses that the BARC can be an organic layer and Kim teaches an organic ARC that has the advantages of superior etch selectivity and the ability to be removed in the same process that is used to remove the overlying photo-resist. Like Applicant's organic under-layer, the organic under-layer of Kim is formed of carbon that is deposited using a source gas of methane, ethane or propane in a CVD process (col. 4, ln. 42-51). Therefore, it appears that the organic under-layer of Kim would inherently possess the function of being rigid. See *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (CCPA 1971) "where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on "); and *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980) (a case indicating that the burden of proof can be shifted to the applicant to show that the subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 U.S.C. 102 or obviousness under 35 U.S.C. 103).

Regarding claim 2, Huang discloses etching away any portion of the IC material that is not under the organic mask (Fig. 4c-4d).

Regarding claim 3, Huang discloses that the step of patterning the organic under-layer involves forming a layer of photo-resist on the organic under-layer, patterning the photo-resist in a photolithography process to form the photo-resist mask structure, and etching away any portion

of the organic under-layer not under the photo-resist to form the organic mask structure (col. 5, ln. 21 – col. 6, ln. 24).

Regarding claim 6, Huang discloses that the organic under-layer is used in the photolithography process to act as a BARC (bottom anti-reflective coating) during the patterning of the photo-resist; therefore, the organic under-layer inherently must be opaque to the light used in the photolithography process (col. 5, ln. 20-25).

Regarding claim 8, Huang discloses forming a hard-mask layer (56) between the IC material and the organic under-layer, etching away any portion of the hard-mask layer not under the rigid organic mask structure to form a hard-mask structure and etching away any portion of the IC material not under the hard mask structure (Fig. 4a-4d; col. 5, ln. 15 – col. 6, ln. 23).

Regarding claims 9 and 10, Huang discloses that the organic under-layer can remain on top of the hard-mask structure or can be stripped away (col. 7, ln. 6-12).

Regarding claim 11, Kim discloses that the rigid organic under-layer should be made of a carbon film deposited using methane, ethane or propane in a CVD process (col. 4, ln. 42-51).

Regarding claim 12, Huang does not specifically disclose trimming the organic mask structure to a width of 10-50 nm. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use routine experimentation to determine an optimal width of the trimmed organic under-layer mask of Huang, depending upon the width of the gate desired because such variables of art recognized importance are subject to routine experimentation and discovery of an optimum value for such variables is obvious. See *In re Aller*, 105 USPQ 233 (CCPA 1955).

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang et al. (US 6,794,230) in view of Kim et al. (US 6,214,637) as applied to claim 3 above, and further in view of Yin et al. (US 6,939,794, previously cited).

Regarding claim 7, neither Huang nor Kim discloses that the organic under-layer is transparent. Like Kim, Yin discloses forming an amorphous carbon layer that is used as a mask for etching. Yin teaches that this organic mask layer can be made more transparent by altering the deposition process of the layer. Yin ('794) discloses that it is advantageous to make the organic mask layer more transparent in order that alignment marks on the wafer can be visibly seen through the mask layer (col. 6, ln. 33-55). At the time of the invention, it would have been obvious to one of ordinary skill in the art to deposit the organic under-layer of Kim such that it is transparent because Yin teaches that an amorphous carbon mask layer can be made more transparent so that alignment marks on the wafer can be seen through the mask, thereby allowing more accurate alignment during photolithography steps.

### *Allowable Subject Matter*

Claims 26-34 are allowed.

The following is an examiner's statement of reasons for allowance:

The primary reasons for the allowance of claims 26-34 is the inclusion therein, in combination as currently claimed, of the limitations of forming a rigid organic mask with a photo-resist mask over the rigid organic mask and trimming the rigid organic mask such that the photo-resist mask is completely etched away during the trimming. These limitations were found in claims 26-34 and are neither disclosed nor taught by the prior art of record, alone or in combination.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### *Response to Arguments*

Applicant's arguments with respect to claims 1-3 and 6-12 have been considered but are moot in view of the new ground(s) of rejection.

### *Conclusion*

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Rogers et al. (US 6,010,829) and Yang et al. (US 5,965,461) disclose forming an organic mask on an IC material and forming a photoresist on the organic mask and trimming both the organic mask and the photoresist together before etching away portions of the IC material not under the masks.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN
April 11, 2006

Michael Trinh
Primary Examiner